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November 16, 2012

## **VIA ELECTRONIC FILING**

Marlene H. Dortch, Secretary  
Federal Communications Commission  
445 12th Street, S.W.  
Washington, DC 20554

Re: ***EX PARTE NOTICE***

Revisions to Rules Authorizing the Operation of Low Power Auxiliary Stations in the 698-806 MHz Band, WT Docket No. 08-166; Public Interest Spectrum Coalition, Petition for Rulemaking Regarding Low Power Auxiliary Stations, Including Wireless Microphones, and the Digital Television Transition, WT Docket No. 08-167; Amendment of Parts 15, 74 and 90 of the Commission's Rules Regarding Low Power Auxiliary Stations, Including Wireless Microphones, ET Docket No. 10-24; Expanding the Economic and Innovation Opportunities of Spectrum Through Incentive Auctions, GN Docket No. 12-268

Dear Ms. Dortch:

On November 14, 2012, Shure Incorporated ("Shure") met with Louis Peraertz, Legal Advisor, Wireless, International, and Public Safety to Commissioner Clyburn, to discuss the above-referenced dockets. Attending this meeting on behalf of Shure were Mark Brunner, Senior Director, Global Public Relations, Ahren Hartman, Director, Axient Wireless Engineering and Edgar Reihl, Director of Spectrum Strategy, along with Catherine Wang and Tim Bransford of Bingham McCutchen LLP, outside counsel to Shure.

During this meeting, Shure provided an overview of wireless microphone use models and technological advancements that have occurred over the last 5-10 years. Shure highlighted the fact that along with advances in microphone technology, demand and use of wireless microphones in increasingly sophisticated media productions have expanded. We explained that audio quality is paramount for professional wireless microphone users, and is affected by a number of technical factors. We discussed Shure's strong view that continued access to clear UHF spectrum is critical to wireless microphone operation, and key to ensuring United States leadership in media and content creation. Finally, we discussed the proposed changes to the Commission's Rules and the UHF frequency allocation under consideration in the Wireless Microphone Proceeding and Incentive Auction docket.

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Bingham McCutchen LLP  
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November 16, 2012  
Page 2

If you have any questions regarding this meeting, please do not hesitate to contact the undersigned. A copy of the attached presentation was discussed during the meeting.

Very truly yours,

/s/

Catherine Wang  
Tim Bransford

Attachment  
CC:

Louis Peraertz

# Wireless Microphone Technology

FCC - OET

14 November 2012

Ahren J. Hartman

Director, Axient Wireless Engineering

# Types of UHF Wireless Audio Products



**Wireless Microphones**



**Wireless Personal Monitors**



**Wireless Intercoms**



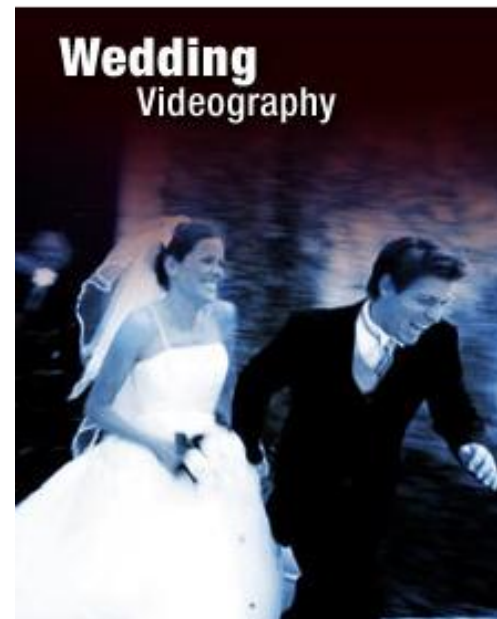
**Wireless IFBs**

# Small Wireless Venues

## School Performances



## Event Videography





# Medium Wireless Venues

## Music Tours



## Corporate Meetings



# Large Wireless Venues

## Houses of Worship



## Theater Productions





# Extreme Wireless Venues

## Global Sporting Events



## Political Conventions



## Auto Shows





# Microphone Spectrum Efficiency

**Technical factors  
affecting microphone  
spectrum efficiency  
in the TV bands**

**Audio Quality**

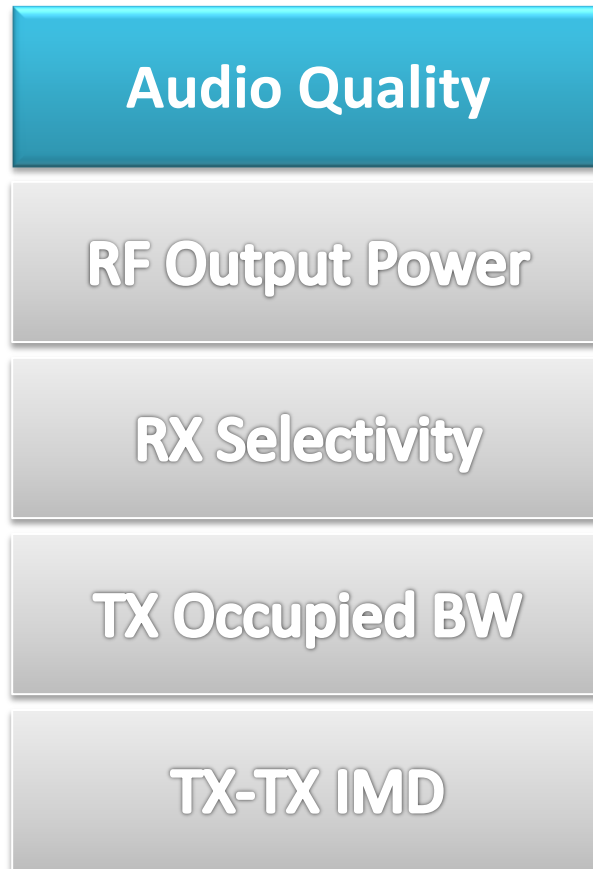
**RF Output Power**

**RX Selectivity**

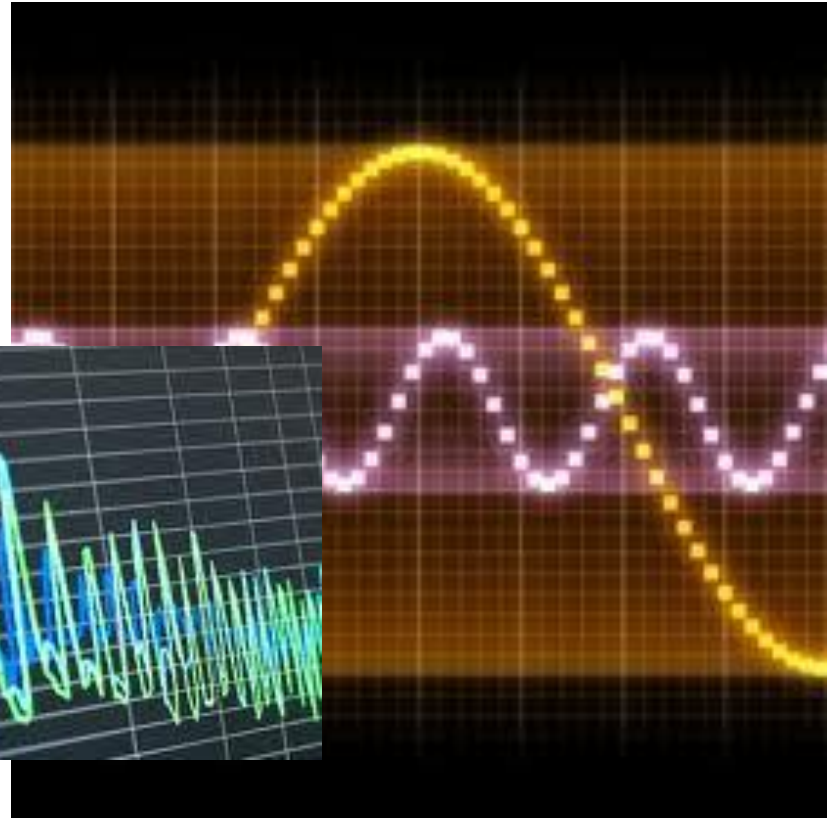
**TX Occupied BW**

**TX-TX IMD**

# Microphone Spectrum Efficiency

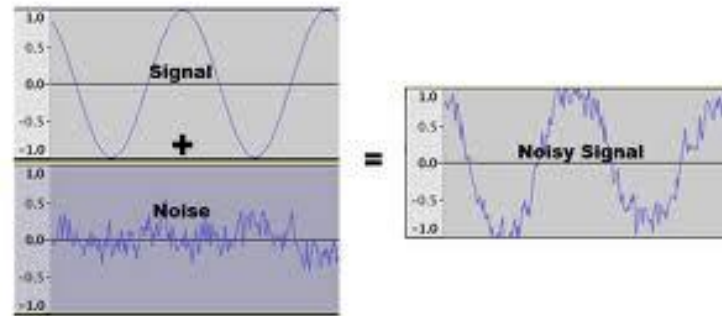
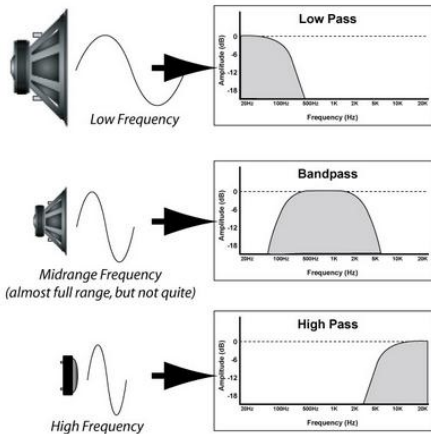


# Audio Quality



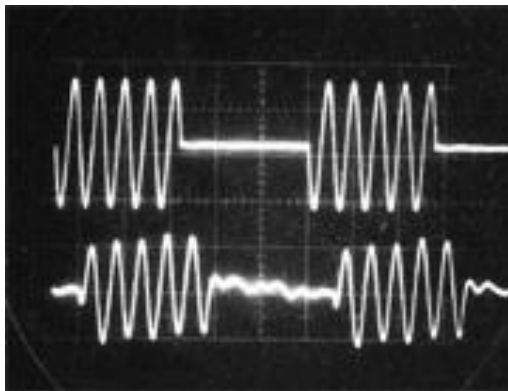
**Audio quality is the leading ingredient in wireless microphone performance.**

# Audio Quality Measures



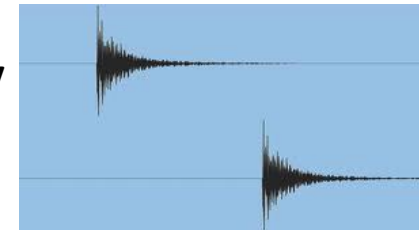
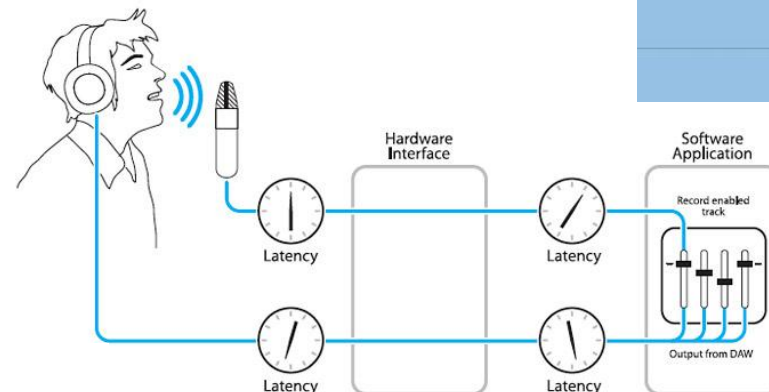
**Signal-to-Noise Ratio**

## Signal Bandwidth



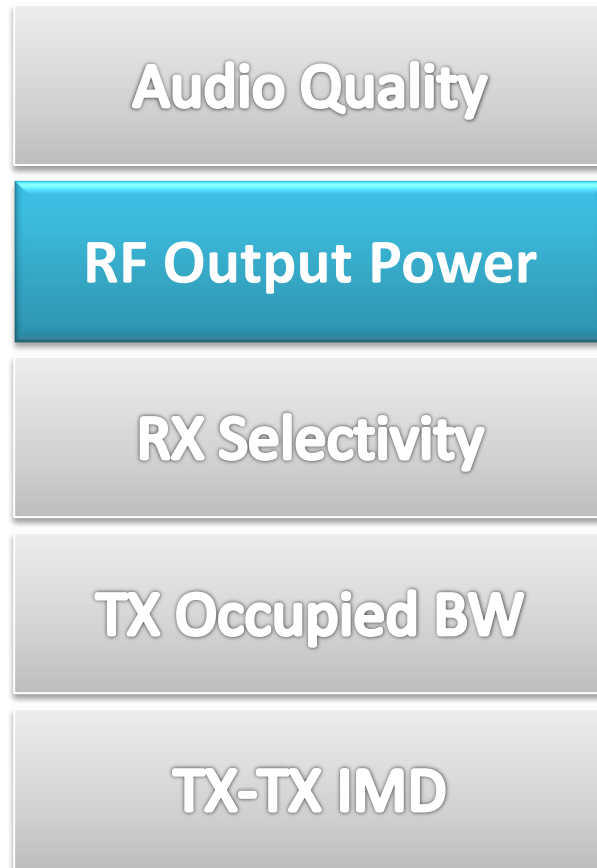
**Distortion and Transient Response**

## Transmitter-to-Receiver Latency





# Microphone Spectrum Efficiency



# RF Output Power

**Transmitter RF output power is influenced by operating distance and harmful interference levels**

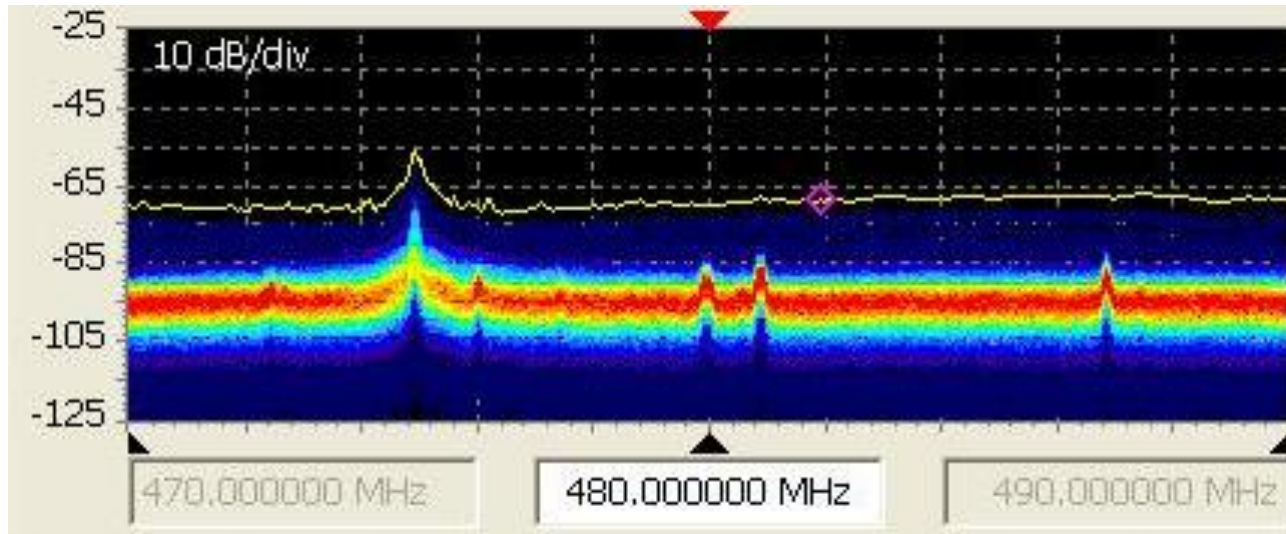
NFL Stadium



Music Video Wall

# Broadband Noise

## RTA scans from major touring concert venue



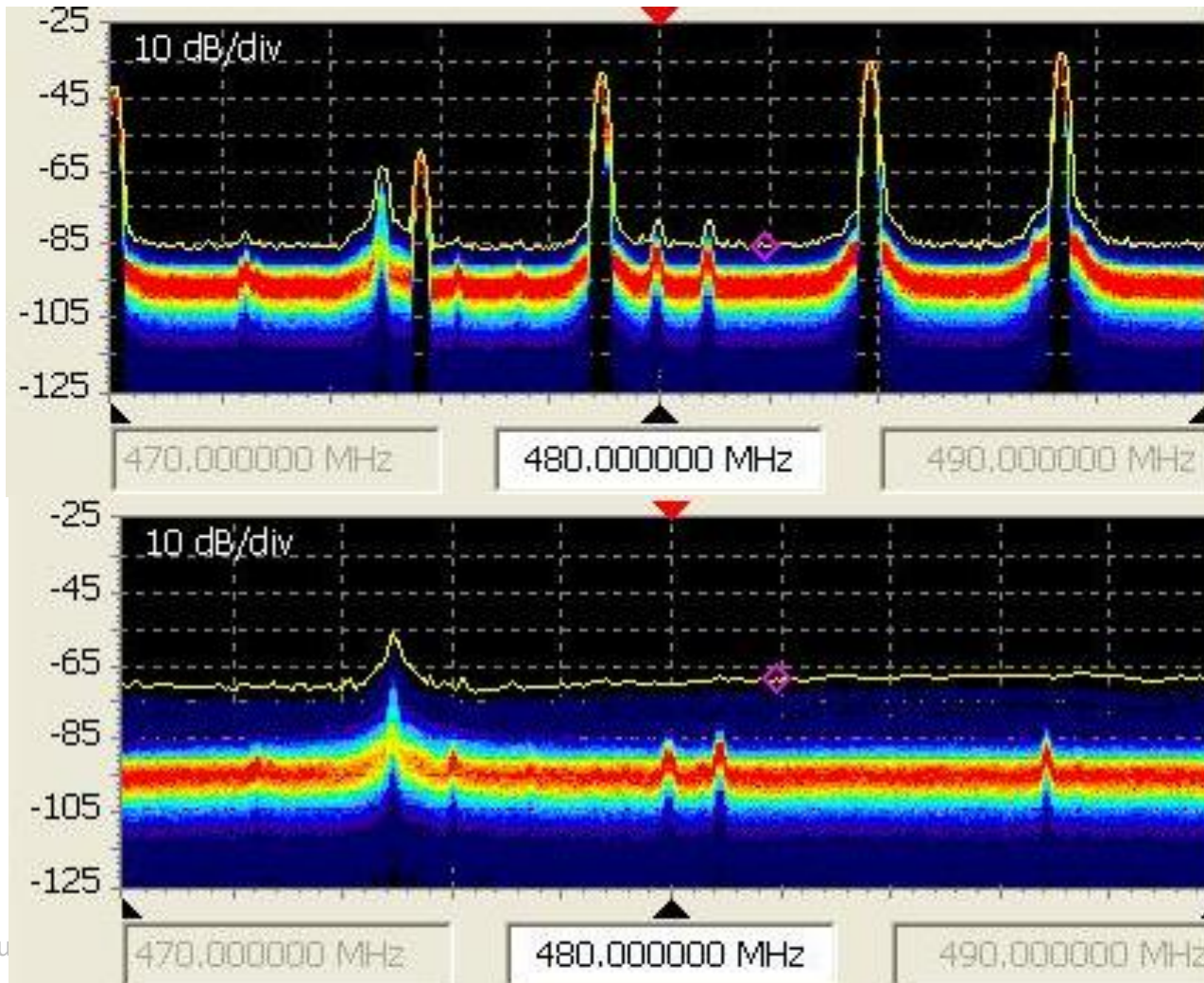
**Before Show**  
**Marker = -85dBm**

**During Show**  
**Marker = -68dBm**  
**(Delta = +18dB)**

**Span = 20MHz**  
**RBW = 100kHz**

# Broadband Noise

## RTA scans from major touring concert venue



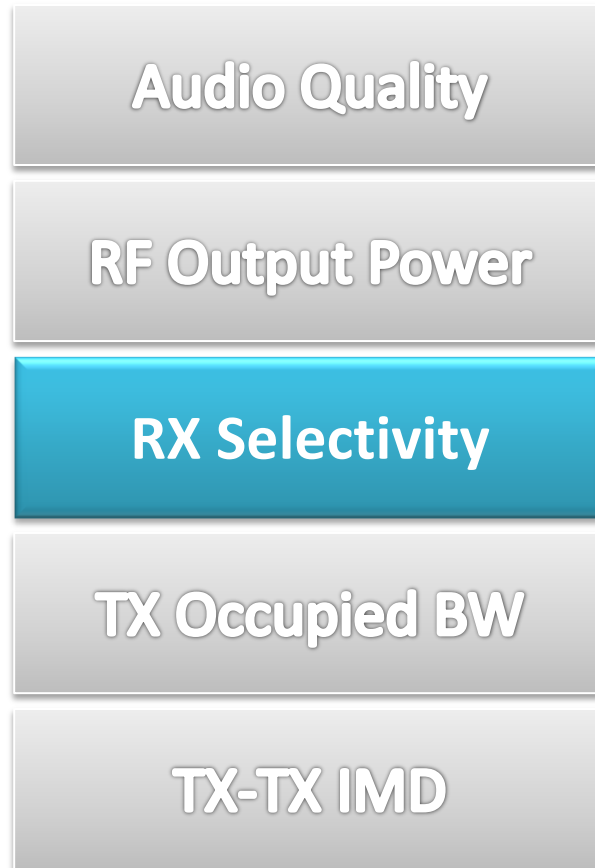
**Before Show**  
**Marker = -85dBm**

**During Show**  
**Marker = -68dBm**

**Span = 20MHz**  
**RBW = 100kHz**

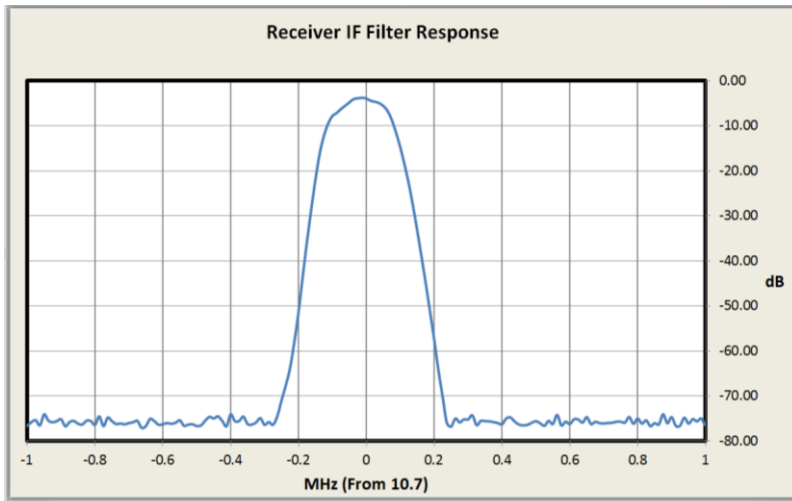


# Microphone Spectrum Efficiency

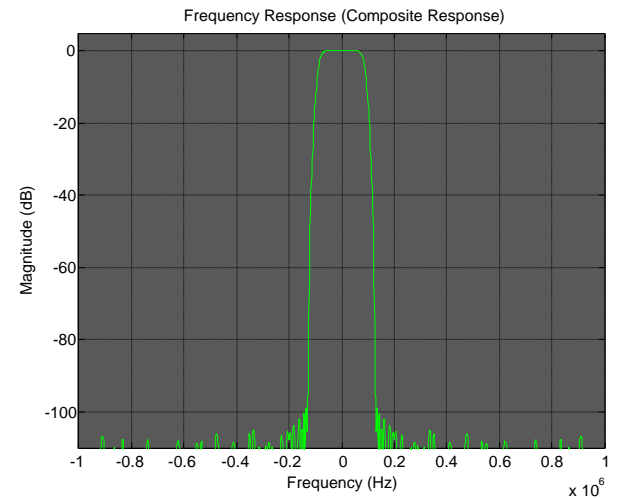
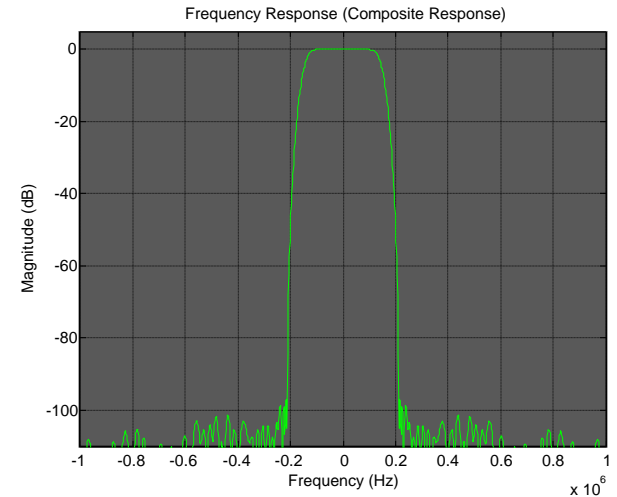


# Receiver Selectivity

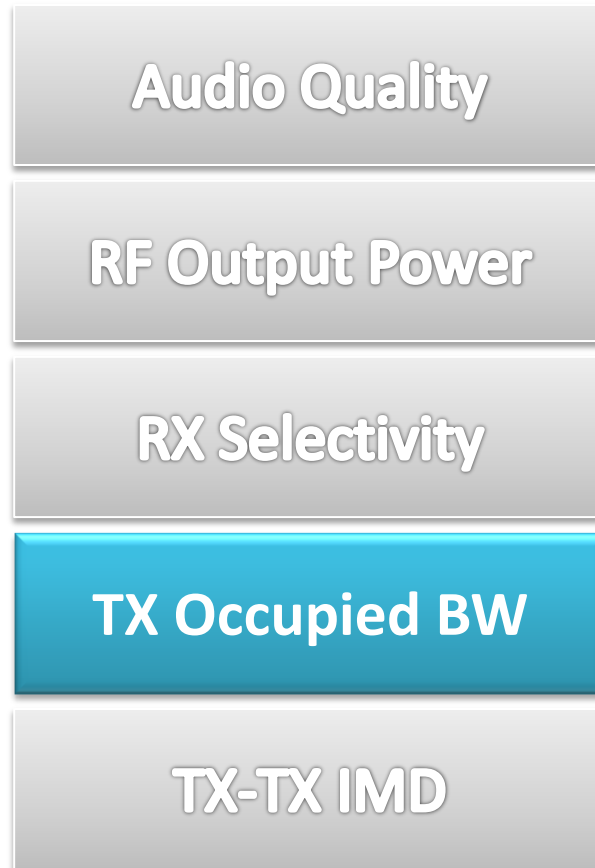
## Receiver IF Filter Example #1



## Receiver IF Filter Example #2



# Microphone Spectrum Efficiency



# TX Occupied Bandwidth

**Analog FM (130KF3E)**



**Digital (165KD1E)**



**Hybrid Digital-FM (180KF3E)**

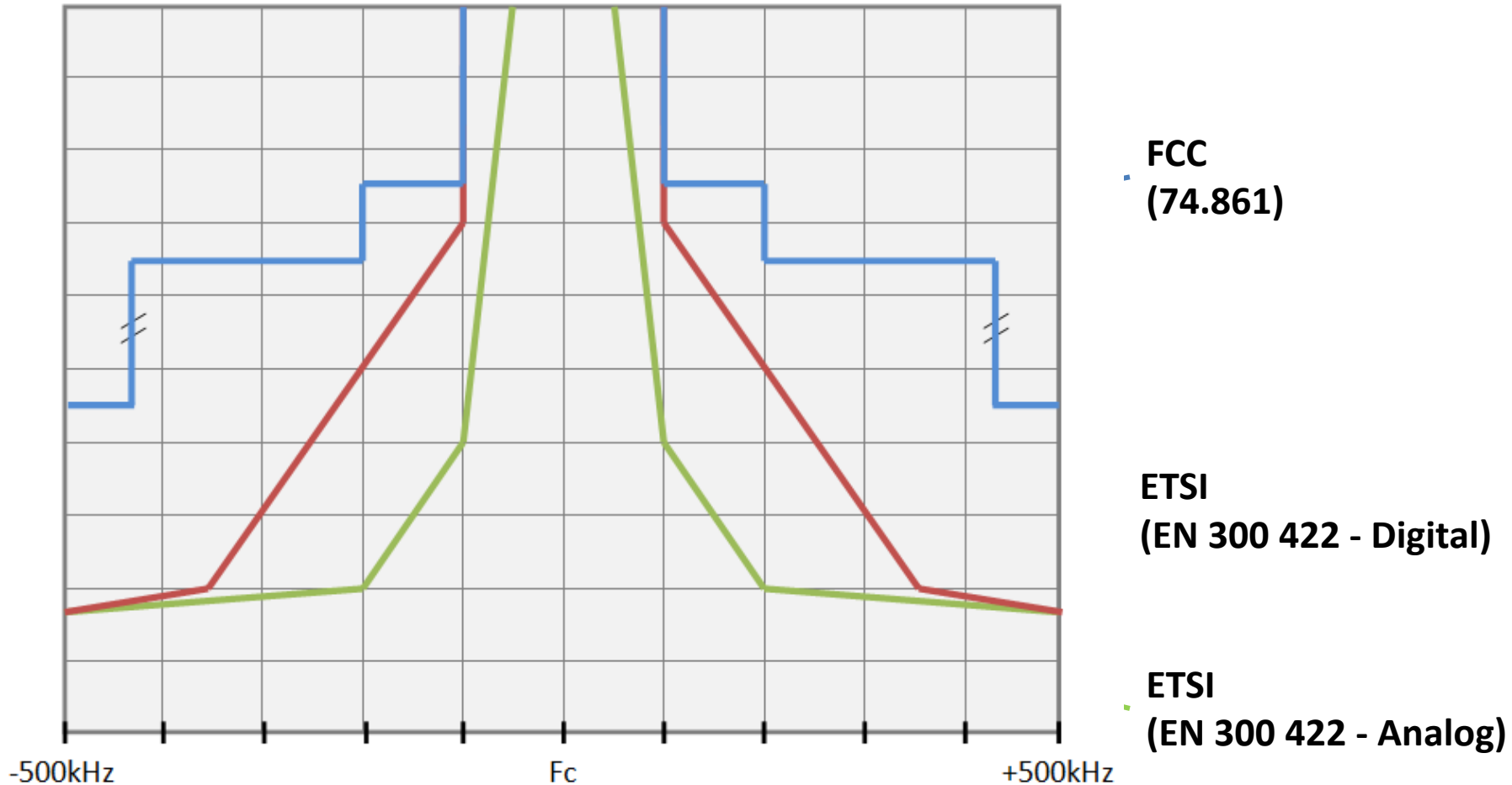


**Digital (171KF1W)**

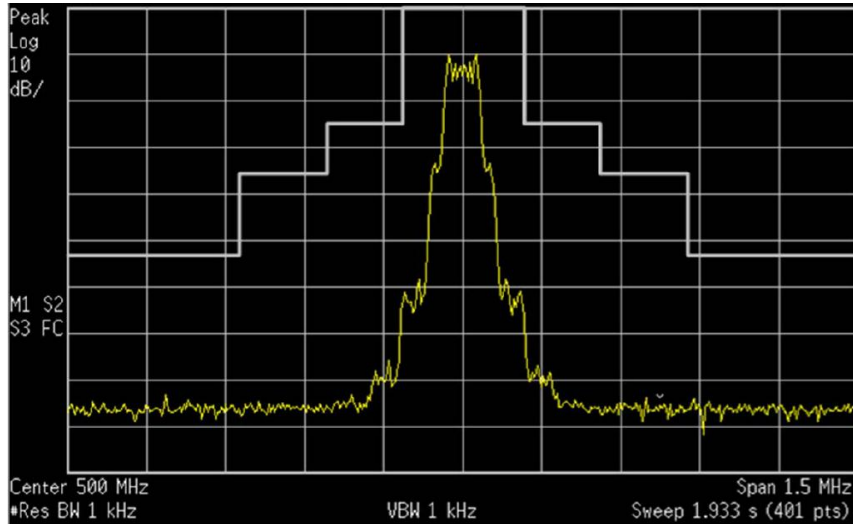




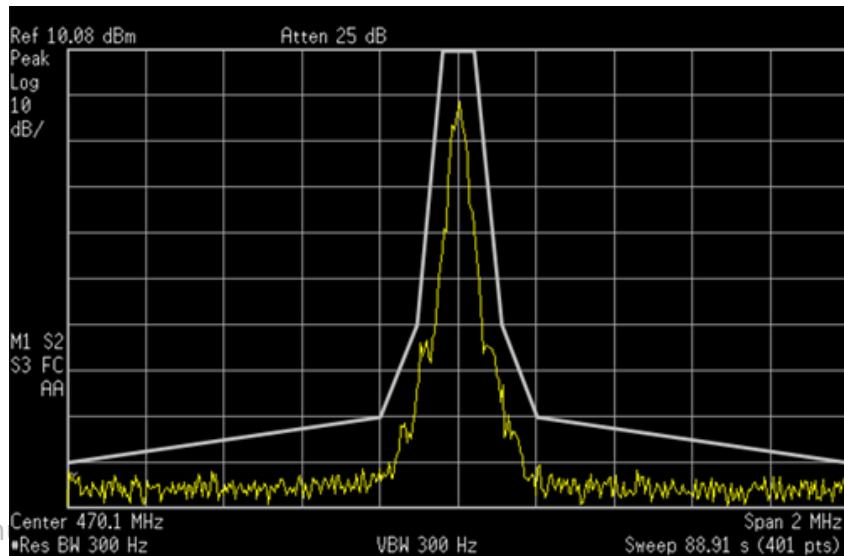
# Regulatory TX BW Masks (UHF)



# Wireless TX Spectrum



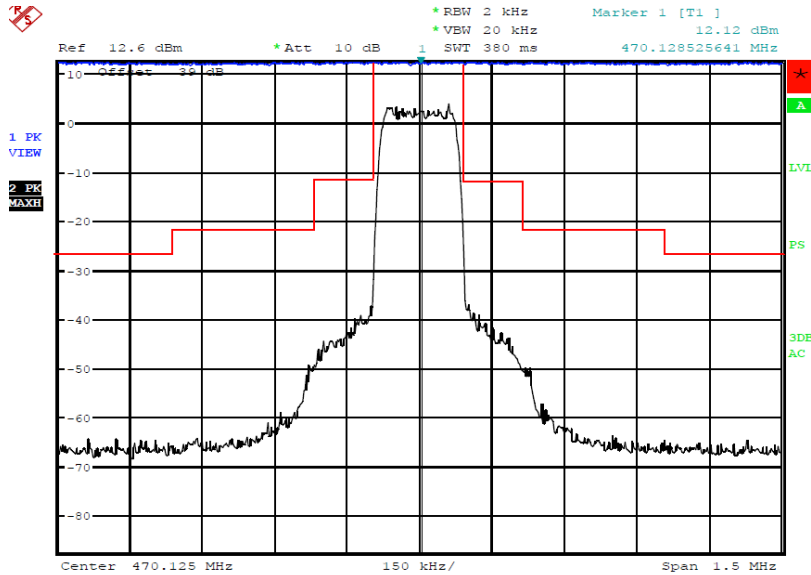
**FCC (74.861)  
Analog Example**



**ETSI (EN 300 422)  
Analog Example**



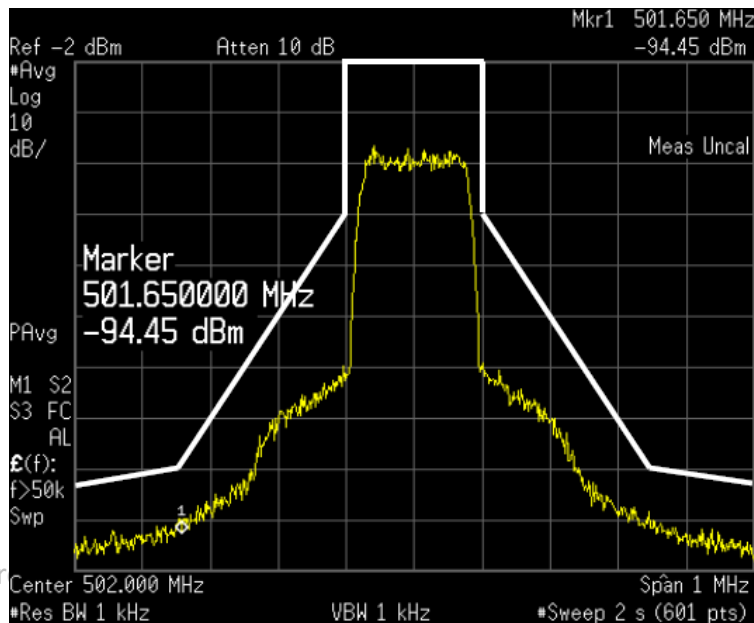
# Wireless TX Spectrum



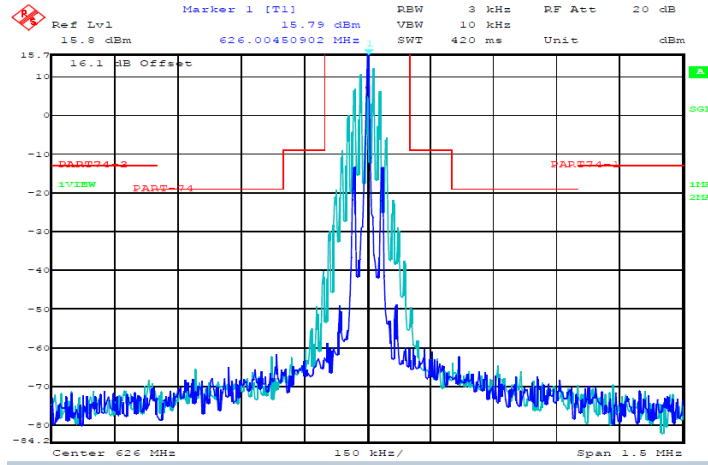
**FCC (74.861)  
Digital Example**



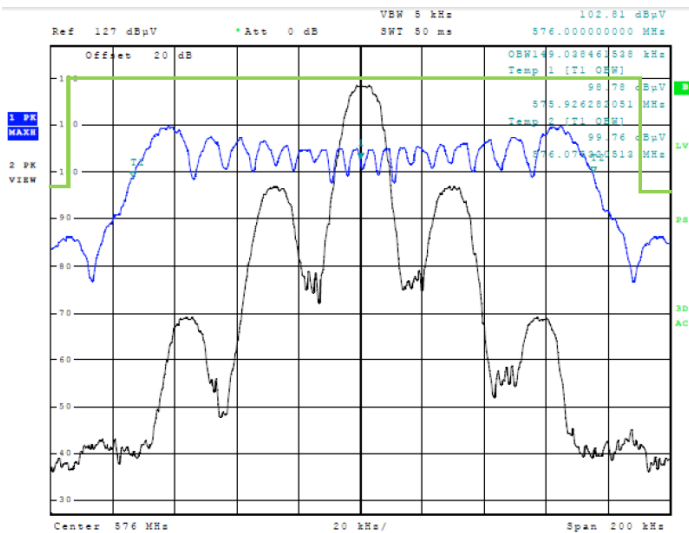
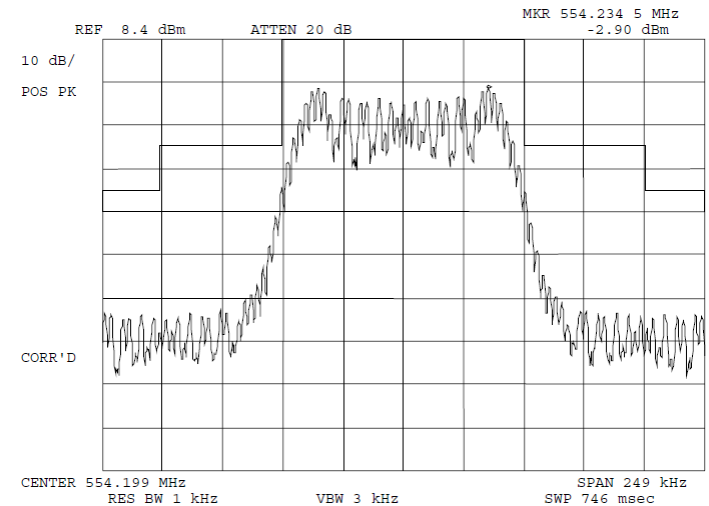
**ETSI (EN 300 422)  
Digital Example**



# Wireless TX Spectrum

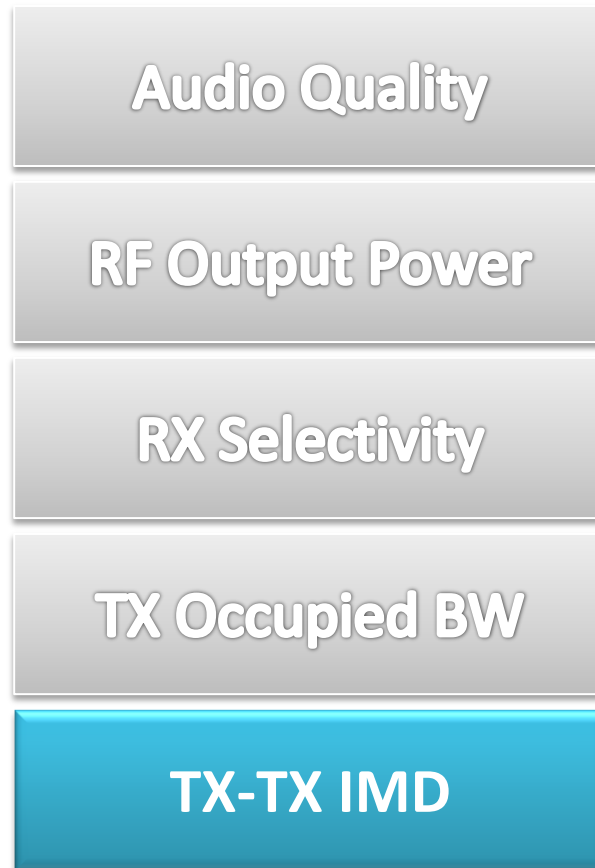


## Analog FM Examples

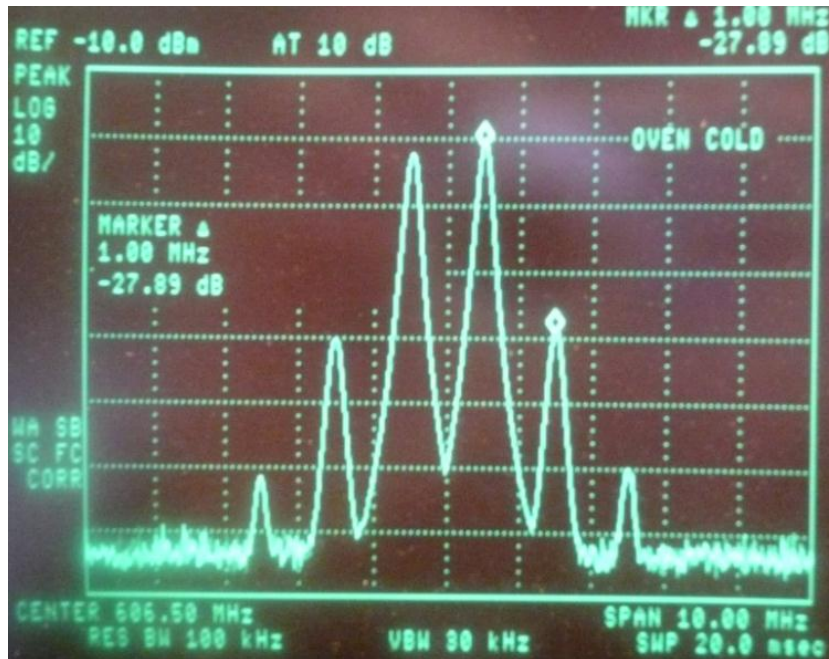




# Microphone Spectrum Efficiency



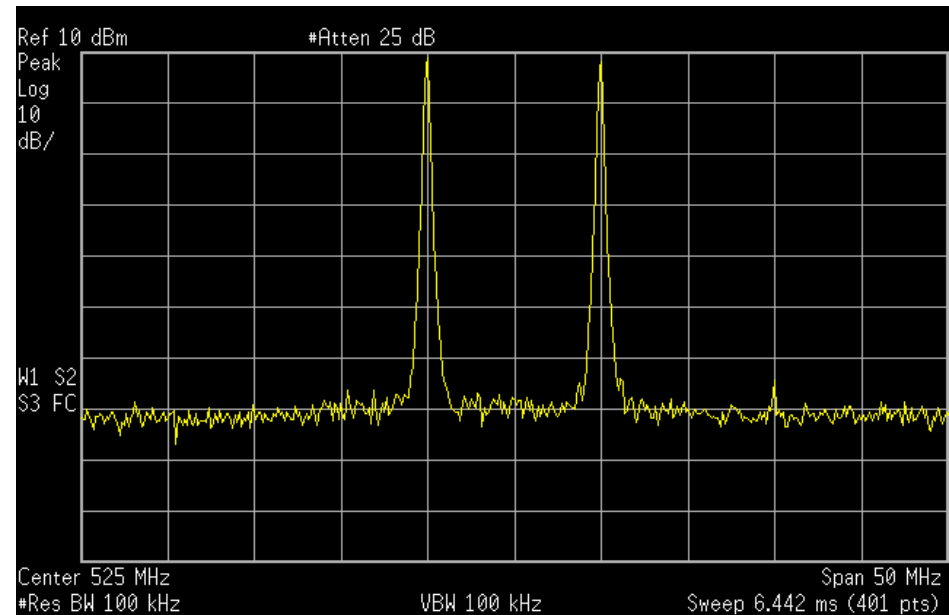
# Transmitter-to-Transmitter IMD



Two Transmitter Example #1

Microphone systems are FDMA and therefore always transmitting

Two Transmitter Example #2



# Summary

- Audio quality is paramount in wireless microphones
- Microphone technology has advanced dramatically in the last 5-10 years and will continue
- Spectral efficiency is increasing; more channels required in less available spectrum
- Clear UHF spectrum is critical for successful microphone operation